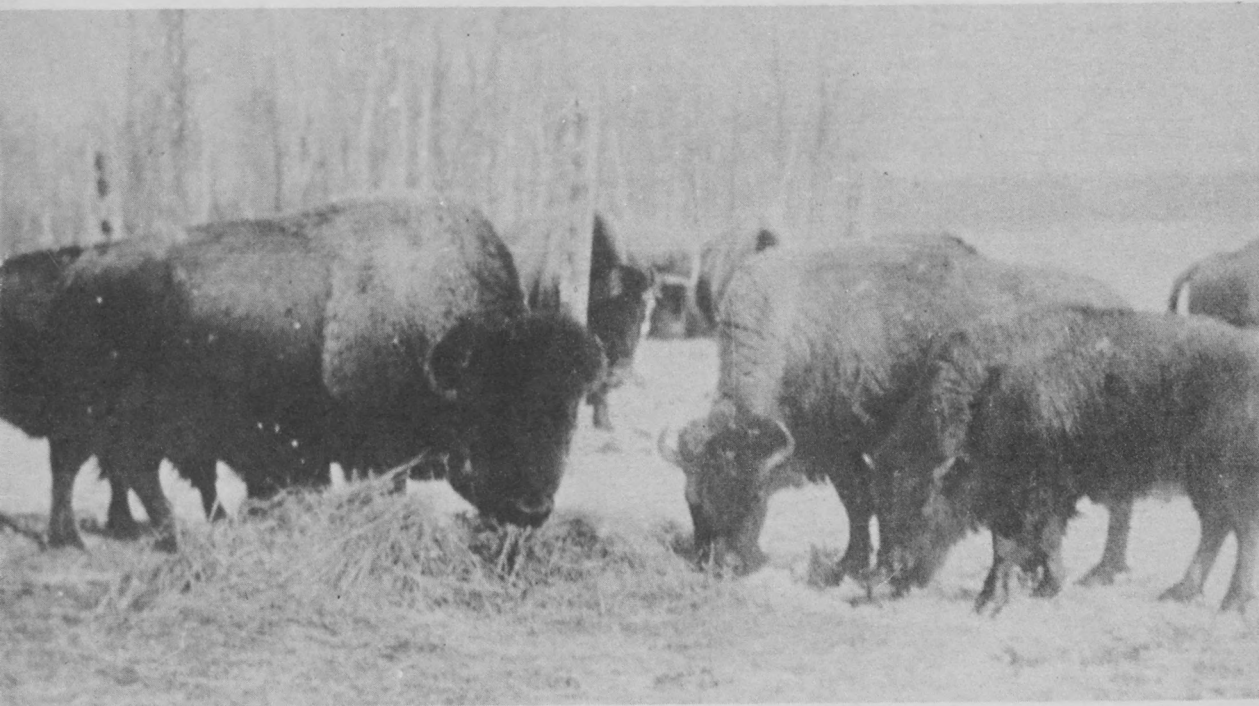




ZOOLOG

VOLUME 11, NUMBER 3

SEPTEMBER 1970



The first Bison to go into Assiniboine Park to which they were transferred from old River Park. The picture was taken on a glass negative by a member of the Moorcroft family, who were among the first photographers in Winnipeg.

This picture is now on exhibit in Red River House, St. Andrews, Manitoba, on River Road, right on the banks of the Red River.

**Publication of the Zoological Society of Manitoba,
and the Natural History Society of Manitoba**

**Published quarterly by the Zoological Society of Manitoba
Editor Dieter H. Schwanke
Assistant Peter Press**

Reprints of articles available on request

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The President's Message

Within several weeks, the new Zoo director, Mr. Clive Rootes, will take up his post. We are fortunate to have Mr. Rootes as Director, for he is remarkable in having accumulated so much experience in so few years. Schooled in Botany and Zoology at the University of London, he apprenticed as a student keeper at Regent's Park Zoo. From there he became Superintendent of a Zoo in Trinidad, and gained much experience in tropical and subtropical animals. He returned to England as General Curator of Dudley and Birmingham Zoos where he was responsible for a collection of 1300 specimens and 390 species. In order to gain the specialized training of curating birds he next accepted Curatorship of "Winged World", a unique collection of 450 rare birds of 230 species at Morecambe, Lancashire. Mr. Rootes did much to improve the aviary's enviable breeding record for exotic birds. Interspersed with these activities he has found time to write two technical books and two popular books on animals.

With the encouragement of the Society the initial decision of Metro's Park and Protection Division to build Fauna Subtropica (See Dr. Seale's article), and more recently to appoint Mr. Rootes, we have a most fortuitous coincidence. Fauna Subtropica needs the guidance and experience of Mr. Rootes if this facility is going to expand the display range of our Zoo. In conversation Dr. Rootes revealed his keenness to accept the challenge of a tropical animal display in our cold climate and to maintain and expand our temperate and boreal collections.

We are fortunate in Winnipeg, for on the strong base erected by Gunter Voss we may expect expansion and development in subtropicals and natives by Clive Rootes. This will maintain our Zoo in its respected international position as a small but impressive facility.

Welcome Clive Rootes! The Society looks forward to your Directorship and to assisting you in developing our Zoo.

H. E. Welch, M.A., Ph.D.

The Fauna Subtropica

in the Assiniboine Park Zoo

The recent decision of the Metropolitan Corporation of Greater Winnipeg to construct a new building, the Fauna Subtropica at the Assiniboine Park Zoo should be a source of pleasure to the citizens not only of Metro but also the rest of the province. The news was particularly welcome to members of the Zoological Society who have been actively encouraging the development and expansion of the Zoo. The Fauna Subtropica should become an outstanding and unique educational centre, one in which Manitobans can take pride: in addition it will enhance the international reputation of the Zoo.

As the name implies, the Fauna Subtropica will contain a number of species, both birds and mammals, which are native to the subtropical regions. It will be located in the region adjacent to the southern end of the hoofed stock area. In this location it will be in close proximity to the new parking lot at the Corydon Avenue entrance.

The Fauna Subtropica, a heated unit, should encourage greater year-round participation and enjoyment of the Zoo's facilities. While more than one million persons visit the Zoo annually, the vast majority come during the period from March to November. A heated exhibit in addition to the present gibbon house, should result in an increase in attendance during the winter season. It is hoped that future

additions to the Zoo will include other heated structures: if these are located in reasonably close proximity to each other, the opportunity will be present for visitors to tour the Zoo in winter alternating between heated buildings and outdoor walkways.

The design of the Subtropica, while well-advanced, will not be completed until after the arrival of Mr. Clive Roots, the recently appointed successor to Dr. Gunter Voss as Director of the Zoo. It is considered very desirable in preparing the final plans to take advantage of Mr. Rootes' considerable experience and knowledge of subtropical regions. In the planning completed to date, the Research and Liaison Committee of the Zoological Society has worked in close cooperation with a planning group of the Parks Division of the Metro Corporation. Members of the Committee have been able to provide advice and technical information on a number of aspects of design and details to facilitate greater efficiency in day-to-day operations.

It is not proposed at the present time to present either a detailed description or sketch plan of the structure: for one thing, as indicated above, some planning and designing remains to be completed. In addition, modern concepts of Zoo design and display tend to dwell lightly on the purely physical considerations of zoo structures.

The Fauna Subtropica should not be regarded simply as a building containing a series of cages and pens in which species from certain geographic regions are confined. Rather it is an architectural arrangement designed to create the mood and character of a subtropical environment. The live animals will be exhibited against a background of plant life chosen to correspond to their natural habitat. Because the exhibit will contain from 10 to 12 kinds of mammals and probably 25 kinds of birds from widely varying regions, a number of environmental and ecological arrangements will be required. It should not be forgotten that the subtropics consist of more than dense, heavily foliated jungles: both deserts and mountainous plateaus can be found within this geographic region. This variety naturally gives rise to a diversity of zoological and botanical species.

Carefully detailed engineering features will assure that the structural elements will be either hidden or unobtrusive. Where possible, the use of foliage will camouflage such services as heating ducts, and power and water lines: all this design and disguise is needed in the realistic simulation of the subtropics.

Let us now accompany a visitor on a brief imaginary midwinter visit to the Fauna Subtropica. (I am indebted to Dr. Voss for the vivid portrayal of this exhibit: it should be remembered that the Fauna Subtropica was a pet project of Dr. Voss and many of the concepts in design were the products of his fertile mind.)

Upon entering the warm climate zone, the wintery blasts are immediately left behind. Before him the visitor will be confronted with warm bright vegetation such as palm trees, savannah grasses and cacti; he will be surrounded by the sounds of shuffling hooves, bird song and splashing water.

On undulating, winding paths he may move to the right to view a Four Horned Antelope divided from him only by a rustic little wall; a few steps further he will be almost nose to beak

with Red Crested Cardinals or Ultramarine Grosbeaks gaily splashing in a pool which forms a barrier between him and bigger beasts.

Behind him, overhanging, will always be some suggestive vegetation; in a floral setting he may find a Roadrunner, Crested Guinea fowl or Blossom-headed Parakeet. In the midst of another cluster of plants he will find a bench from which he can watch a group of Patas Monkeys in one enclosure and Arabian Gazelles in the adjacent area.

Our visitor next moves to a corner containing cages of Masked and Peach-faced Lovebirds cooing to each other. Adjacent is an Australian scene with Red Kangaroos, Bennett's Wallabies and Emus. Here in this large pool are East African Crowned Cranes. Seldom is he fully aware of the glass partitions between adjacent areas, nor does he appreciate upon his first visit that the undulating path enables him to look down upon this group of animals and up to those in the next area. The scene is always changing.

During his trip our visitor may well speculate and contemplate on the variety of Nature. Why the multi-coloured species of the subtropics as contrasted with the black and white animals of our northern land? How can we protect this endangered species which hovers on the brink of extinction? Why is there only one four-horned antelope in the world?

And so our visitor has been enlightened; his interest in biological principles has been aroused. He resolves to return soon and during the summer when many of the species will be enjoying the bright outdoor sunshine.

The date on which the construction of the Fauna Subtropica is completed is indefinite at present but the late summer of 1971 is not an unreasonable guess. The citizens of Manitoba should await with anticipation and enthusiasm this significant addition to Assiniboine Park Zoo.

M. E. Seale
Department of Animal Science
University of Manitoba

The Bison: An Emblem of Progress

The bison is one of the symbols of our Manitoba Centennial and has a central position on our provincial coat of arms.

I would like to tell you why this is so, and also to re-examine a classical case of near extermination. Both, I hope, will be enlightening; on one hand to reveal something of the early history of the province and secondly to determine if there has been any progress in our concern for natural resources since the buffalo story first unfolded.

Prior to the eighteenth century North America was over-run with Bison from Great Slave Lake to the Rio Grande, from the Rockies to the Potomac. Their distribution was irregular but the great herds described by the early explorers were confined to the prairies and tree-less plains.

The Plains Bison were first described in the rhymed couplets of Henry Kelsey. He saw them south of the present site of The Pas on August 18, 1691. La Verendrye and his son described them next in the southwest when they explored the Winnipeg, Red and Roseau Rivers. Curiously it was not until the French traders learned from the Cree Indians how to prepare pemmican that they successfully invaded the Red River valley and built a series of posts to the junction in the Saskatchewan River.

"Pemmican" was a Cree word for "lean fat", and the food of the voyageurs, a pound and a half per day was the ration. Its composition and appearance is best described by a practical joke told by Henry John Moberly and played on himself by Sir George Simpson, the Governor of the Hudson Bay Company — "the Governor passed me a dish which I promptly declined. He urged me to try it, but I still refused. At length he asked why I would not touch it. 'Sir George' I replied, 'I may be a green man, but you won't catch me eating bear's drippings'. This brought a roar of laughter from all sides. The governor ate a portion of the delicacy himself, upon which I made

bold to test it and to my surprise found it extremely good. It proved to be berry pemmican of the best quality, made of dried pounded buffalo tongues, marrowfat, sugar and dried Saskatoon berries. In appearance it was exactly what I had called it".

Huge herds of buffalo roamed the lush grasslands of the Red River valley. Alexander Henry, who operated the North West Company post at the junction of the Red and Pembina Rivers, 60 miles south of Winnipeg, told many remarkable stories of their abundance. Apparently the area, including present Fort Garry, St. Norbert, River Heights, and Tuxedo was a major overwintering site. Henry laconically remarks in one of his accounts that if it had not been for the buffalo the grass would have been awfully high!

The Bison herds were an important source of pemmican and its value to the fur traders and Selkirk settlers led to the Pemmican War.

These hardy settlers had been granted holdings by the Hudson Bay Company. Their arrival at the Red and Assiniboine Rivers on Sept. 4, 1812 was too late for planting crops and they went to Pembina to live out the winter on buffalo and pemmican.

Inevitably conflict arose between traders and settlers. Miles Macdonell, leader of the Settlers, forbade export of pemmican and seized the supplies of the North West Company. Métis in employ of the Company terrorized the settlers and events culminated in the Seven Oaks Massacre of Governor Semple and 19 settlers. Peace came only after the fusion of the North-West and Hudson Bay Companies in 1820.

In 1824 the settlers realized the economic potential of the plentiful Bison and Manitoba's first enterprise was organized — the Buffalo Wool Company. John Pritchard raised \$10,000 by sale of stock and the Hudson Bay Company advanced \$22,000. A factory was built to tan hides and to weave the hair into cloth. The first shipment of cloth reached Britain in 1822 and

was a fashionable curiosity. Next year the bubble burst. It cost \$12.50 to produce a yard of buffalo cloth but brought only \$1.10 on the market. Undauntedly the Company shipped 400,000 pounds of buffalo tallow to England, but transportation costs were too high and the venture failed. Western Canada's marketing problems seem to have started early.

These commercial demands plus the fur traders' need for pemmican forced the organization of the Red River Hunt. Two main parties went forth; the river party from Fort Garry, and the White Horse Plains party from St. Francis Xavier. Their destination was the Pembina River where the hunt was organized under an elected president, councillors, captains and guides.

When the buffalo were found, hunters approached the herd upwind. At a signal the hunters charged. Each hunter rode up beside a Bison, shot, dropped a marker on the fallen animal, and rode on. He recharged his gun on the gallop and shot the next animal. The scene is marvellously depicted in the major diorama in the Manitoba Museum of Man and Nature. The women stripped the carcasses of their robes, fat humps, tongues and other choice cuts. Meat was dried, pounded, and made into pemmican for sale at 3 pence per pound to the Company or settlers.

Alexander Ross related that the hunt of 1840 under Jean Baptiste Wilkie included 1630 people who took with them 1,210 Red River carts, 655 horses, 600 oxen, and 500 dogs. An eyewitness relates that 400 hunters rode out at one time and returned with 1400 buffalo tongues. One million pounds of meat were brought back on this particular hunt.

In the twenty years following the end of the Pemmican War to 1840 the hunters killed over 650,000 buffalo. The result was what the Nor'westers had feared, the extermination of the buffalo from the Winnipeg prairie. No herds were found in the Red River basin after 1847. Each year the hunters went

farther west. The last buffalo herd was seen in Manitoba in 1861. In 1874 the Red River hunt went as far as the Cypress Hills in southwestern Saskatchewan. Isaac Cowie reported the last Canadian hunt in 1888 at the Red Deer River, Alberta.

In the United States the systematic destruction of the herds began in 1860-70's. In the 1860's the railroads were built across the western states, and the Bison divided into two great herds, the southern and the northern. Many animals were killed to feed railway crews and army posts. In 1870 the trading of robes, hides and tongues became a major industry and an estimated 2,000,000 Bison were killed annually on the southern plains. In 1872 an average of 5000 Bison were killed each day, every day of the year. In 1874 the southern herd was gone. By 1883 the northern was gone.

The original population estimated at 60 million animals had been reduced to 100 with the major kill in the decade from 1872 to 1882. It was a slaughter of staggering proportions!

The literature reveals the dramatic suddenness with which the herds disappeared from the prairies. The Bison were soon only a memory. Their destruction meant the end of Indian resistance in the United States and in Canada, the adoption of policies of relief and reservations.

As if to remove the last evidence of the once great herds the bone collecting industry sprang up. Bison bones brought \$3.00 to \$6.00 per ton and were used in fertilizer and the refining of sugar. In 1890 buffalo bones were the prairies' major export on their new C.P. Railway. Saskatoon alone was known to have accounted for more than 3000 railway carloads. The boom lasted until 1893 when the market fell, and such buyers as the Northwest Fertilizer Company went nearly bankrupt and stopped buying. But by that time the bones had become scarce anyway.

In June, 1876, the Winnipeg Free Press predicted the extermination of the buffalo from western Canada. The

Northwest Council passed a law to preserve the buffalo in 1877. White, Métis and Indian hunters observed it only near the mounted police posts. In 1893 the Canadian government forbade the killing of Bison. The start of patrols by the Northwest Mounted Police began to bring protection from 1897 onwards.

Similar laws were passed in the United States, but in 1897 the last four wild buffalo were shot. In 1900 the mighty herds had been reduced to 541, including both wild and captive animals.

In 1907 the biggest captive herd of Plains Bison was owned by Charles Allard, a French-Canadian and Michael Pablo, a Mexican, in Montana. They offered to sell the herd to the U.S. authorities but were refused. Norman Luxton of Banff suggested to the prime minister, Sr. Wilfrid Laurier, that Canada purchase it. The herd was bought for \$245 per head and moved to Elk Island and to Wainwright, Alberta.

Several legends surround the origin of the Allard/Pablo herd. Two Winnipeggers, Charles Alloway and James McKay brought three buffalo calves from Saskatchewan to a corral at Deer Lodge, St. James, Winnipeg. Next year two heifers and a bull were added and by 1878 they had 13 purebreds and 3 cattalo (cross with domestic cattle). In 1880 these were sold to Col. Sam Bedson, warden of Stony Mountain Penitentiary. Eight years later 27 purebreds were sold to Donald Smith, later Lord Strathcona, and the rest to an American called Buffalo Jones. He took them to Texas but heat and ticks were too much and the herd was brought to Montana and sold to Allard and Pablo. These men already owned a small herd purchased from an Indian called Walking Coyote. He, in turn, had captured them in Canada, and according to Calgary authorities, taken them to Montana to appease his angry mother-in-law. Whether he succeeded or not is unknown, but they became part of the foundation herd that Canada purchased.

Interestingly, five buffalo from Donald Smith's herd were given to the City of Winnipeg. The accompanying photo shows these animals just prior to their donation to the City. This small herd plus some bears were really the cause for the establishment of Assiniboine Park Zoo. Their descendants may still be seen in the zoo and are probably the only true purebred Plains Bison.

A larger, darker, northern form, the Wood Bison, was first seen by Samuel Hearne in 1772, and described as a separate subspecies by Samuel N. Rhoads in 1897. With the creation of Wood Buffalo Park in 1922, these herds multiplied from 300 to 1500.

So did the Plains Bison herd at Wainwright. Zoologists were shocked at the announcement of the Dominion Department of the Interior that excess Plains Bison from Wainwright would be shipped to Wood Buffalo Park. They feared the loss of the Wood Bison subspecies through interbreeding of the two. A controversy broke with the Minister, Hon. Charles Stewart and Ernest Thompson Seton against North American zoologists. A most persuasive objection was published by an anonymous Canadian zoologist in the Canadian Forum of 1925. The author is unknown to me, but his statement could well be the model for the numerous criticisms of government and private activities that have been written by Canadian zoologists. Dissent seems to be not only a recent but also an early characteristic of Canadian zoologists.

Despite these pleas, 6,673 Plains Bison were transferred in 1925 and 1928. Inevitably the two subspecies interbred and it was assumed that the Wood Bison had disappeared. At the start of World War II Wainwright Park was cleared for military purposes and another shipment of Plains Bison went north to Wood Buffalo Park.

In 1967, Novakowski of the Canadian Wildlife Service found an isolated herd of Bison in the extreme northwestern part of Wood Buffalo Park. Subsequent investigations revealed that this was a herd of 200 purebred Wood Bison.

Diseases were introduced to Wood Buffalo Park with the transfer of the Plains Bison and threatened the herd. In 1961 anthrax was discovered in the Wood Bison. They are fewer in number now, but a decentralization of the herd may help to preserve the species.

Semi-wild Bison returned to Manitoba on Nov. 4, 1931, when 16 cows and four bulls were unloaded at Ashville from the train that had brought them from Wainwright. They were driven into a corral in Riding Mountain National Park, and have remained there as emblems of our heritage.

A wild herd was finally established in Manitoba in 1968. Twenty hybrid Bison were moved from Alberta to The Pas, Manitoba. Problems surrounded this release, even though the site was close to the one of first observation by Kelsey in 1691. As soon as the animals were released, they bolted and headed for Saskatchewan. Eventually the herd was corralled, for the animals had destroyed some agricultural crops. Loaded into trucks, they were taken to the Interlake area and released north of Gypsumville on highway No. 6. Periodic reports reveal that the herd has moved west again and some animals have been seen on Birch Island in Lake Winnipegosis. Thanks to the Manitoba Department of Mines and Natural Resources, the honour of the Bison province has been retrieved and again we have a wild herd of Bison in Manitoba.

So ends the bison story. A tragic story with a reasonably happy ending. A happy ending not by design or intent, but by two incredible strokes of luck, the existence of the Pablo/Allard herd, and Novakowski's rediscovery of the Wood Bison.

Have we made any progress in our concern for natural resources over the buffalo days?

Whether you know the buffalo story or not, it probably has a painfully familiar plot. It could have been about any one of a host of animals, the Passenger Pigeon, the Heath Hen, Blue Whale, Pribilof Seal, Sturgeon,

Alligator, Orang Utan or numerous plants.

Its familiarity arises from our knowledge of the steps to extermination. First is the discovery of a use for a plant or animal, then follows a reasonable utilization in which harvest does not exceed production. Next follows harvest beyond production. Often the reserves of the organism are unknown or the excess utilization is of short term. The final step, however, is the invidious one. Various authors call it overkill. It was either the frantic slaughter of Bison to supply market demands before the price fell, or the political objection of making the Indians destitute in order to permit the opening of the West. Overkill in the Blue Whale industry is the need for return on high capital investment for ships and facilities. Overkill for the Polar Bear is the hunter in TIME MAGAZINE who is killing now because he might not be able to do so ten years from now.

The literature of the early twentieth century on the disappearance of the Bison and the causes, predation, disease, inability of the Bison to adapt, seems almost naive now. We have progressed — we know that it was man's insatiable demands on the environment.

Progress has been made in another sense. Our knowledge of the extermination process has made people more responsive and created incentives for action so that many endangered species are often saved. Conservation agencies, government and private, international and local, are making progress in the preservation of endangered species.

But what of the real issue — man's failure to recognize his dependence on the environment. Here progress is very hard to measure. Some people still believe that we are discovering our resources, many believe that we are utilizing our resources wisely; most believe we are depleting our resources; and many fear that we are overkilling them.

How far do you think we have progressed?

H. E. Welch, M.A., Ph.D.

Norman and Stuart Criddle

Manitoba's Pioneer Naturalists

Undoubtedly the best-known of Manitoba's naturalists is the much renowned Ernest Thompson Seton. Few are aware of a family contemporary with Seton and residing in his own southwestern Manitoba who did equally as much to further the knowledge of Manitoba's natural history, albeit in a quieter way. In May 1968 an honorary Doctor of Science degree was conferred on Stuart Criddle at the first convocation of Brandon University. Who was he and why was he selected for this honour?

Readers of The Canadian Field-

Naturalist of the early 1900's (then The Ottawa Naturalist) will have noted a frequency of papers by two brothers, Norman and Stuart Criddle, whose address was given either as Aweme or Treesbank, Manitoba. Neither locality is commonly found on maps of Manitoba yet specimens in many scientific collections, particularly those of insects, are identified by the locality: Aweme.

Norman Criddle, the eldest brother in a family of eight, was early recognized for his careful paintings of wild-



Norman Criddle and the first entomological laboratory at Aweme. Courtesy of Alma Criddle

flowers. His artistic ability served him well when in 1906 he was chosen to illustrate Clark and Fletcher's *Farm Weeds of Canada* and later Clark and Malte's *Fodder and Pasture Plants* in 1913. Botany was an early interest and one that never quite disappeared, yet it was suppressed in favour of the entomology that became his life's work. Grasshoppers were his specialty and the tremendous debt owed him by early prairie farmers is probably unrealized. His development of the "Criddle mixture" for grasshopper control brought

scientists from as far as Europe and Asia to study the tiny laboratory at Aweme. Insect control facilitated a careful study of the ecology of many species of grasshoppers and the development of an extensive insect collection representing most species indigenous to the area of Aweme and many foreign ones as well.

Like those of his brother Stuart, Norman Criddle's interests encompassed many fields so that both would have found themselves at home with the "multidisciplinary" and "ecologi-

cal" concepts of the environment so popular today. Bluebird boxes, a common sight now on western Manitoba fenceposts, had been successfully used at Aweme prior to 1920. Population fluctuations in any type of wildlife greatly interested Norman Criddle and his observations of grasshopper numbers helped in later forecasting of outbreaks of these insects. One of the last papers published before his untimely death in 1933 was an attempt to relate grasshopper abundance with sunspot activity.

In the realm of wildlife population studies, Norman's interests overlapped on those of his younger brother Stuart, who although no longer resident in Manitoba for the last ten years, still carries on meticulous observations and recordings.

As determined from his writings, Stuart's chief interest is mammals and in particular the small rodents of the Aweme area. The discovery of at least ten species or subspecies of mammals in Manitoba is credited to him and the life histories of many small mammals were recorded and published in detail. His interests frequently, however, strayed from mammals. In 1937, he published a paper describing a hibernating aggregation of snakes which is still quoted and is of particular interest today with the sudden concern over snake hibernacula which has developed during the last year. Almost unknown are his experiments with cross-pollination which he carried on at the family home at Aweme. The current problems of duck depredation were not foreign to him as he once stated that it was only in 1905 that ducks discovered the grain fields, having fed prior to this on wild rice planted by the Hudson's Bay Company.

What circumstances caused such a wealth of knowledge to originate from a settlement as small and isolated as Aweme? Formal schooling was scanty by today's standards and the brothers did not have ready access to such accepted advantages as universities, libraries and museums.

The influence of their parents on Norman and Stuart was undoubtedly a major factor. Percy Criddle was very well-educated both in Germany and his native England and came to Canada in 1882 fluent in several languages and with a wide knowledge of law and medicine. His wife Alice was one of the first women to attend Cambridge University. That the Criddles and their four children were not the typical immigrants to Canada is reinforced by an entry in Percy's diary in 1882 deploring the utter lack of napkins and the fact that only one butter knife had been seen in America. Their influence resulted in the house on the prairie sheltering in addition to the typical equipment of the settler a large library, telescope, spinet and an organ.

Percy's diary with its careful recording of events around him indicates the faculty for careful observation that was passed onto his sons. This, when coupled with their keen interest in natural history always encouraged by both parents resulted in a careful chronicling of occurrences at Aweme.

Norman gave credit to his mother's influence in his writings mentioning that through her teaching he could identify numerous English birds (he would have been about seven years old when the family emigrated) and that she raised caterpillars so that he came to know the butterflies and moths into which they developed and their food plants. Although they had arrived at Aweme only the previous fall; Stuart has recorded that their parents had the children collecting local insects by the spring of 1883.

Why then is the work of Norman and Stuart Criddle so significant in Manitoba's natural history? One reason is their very detailed and accurate recording. Nothing was too small to be investigated thoroughly and they did not succumb to any of the preconceived notions of a species being arbitrarily "good" or "bad" which troubled other contemporary naturalists. Their records are valuable because of the long period of time which they encompassed —

over fifty years, thus documenting fairly long term changes. The observations of the Criddle brothers came at a time unique in Manitoba's history when the land was changing to a settled agricultural condition. Thus the Criddles faithfully chronicled the increase and decline of Pinnated Grouse and the replacement of Mule Deer by Whitetails as well as the effects of settlement and agriculture on other lesser known species. Their studies were not confined to a single species or condition but rather covered almost all aspects of their surroundings to give a remarkably complete picture of southwestern Manitoba in the late 1800's and early 1900's. Aldo Leopold recognized their achievements in 1949 when in A Sand County Almanac he mentions them as "recognized authorities on everything from local botany to wildlife cycles".

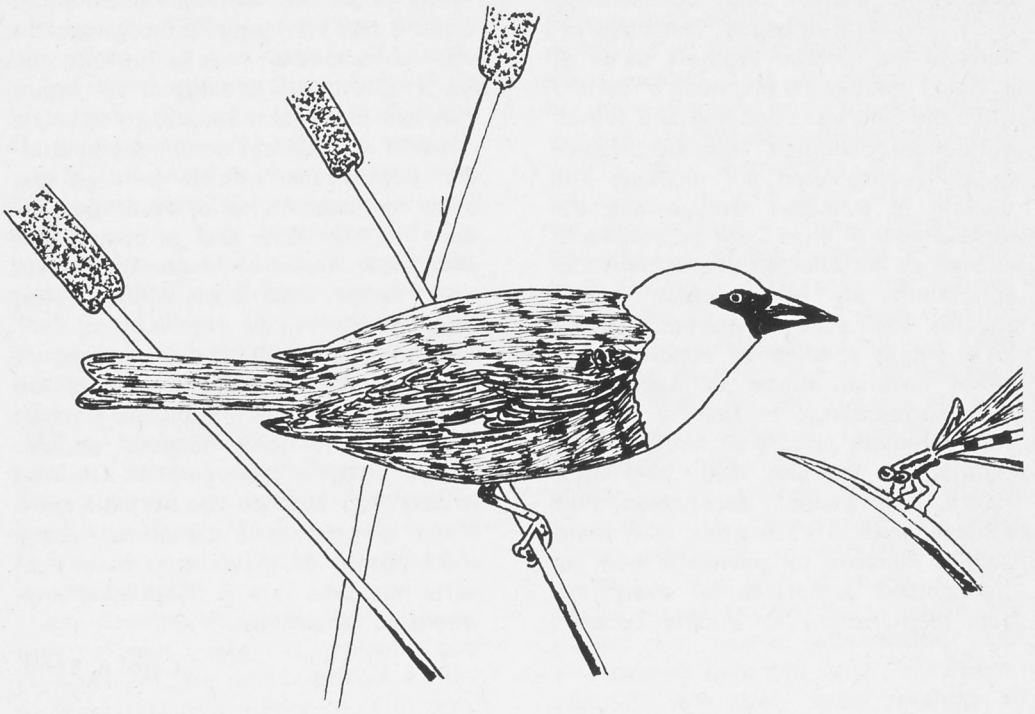
The work of Norman and Stuart Criddle has not gone unrecognized. It was a resource heavily utilized by Dr. R. Bird in his Ecology of the Aspen Parkland of Western Canada in 1961. The detailed records of fluctuations in wildlife populations formed part of the basis for examination of cyclic populations in Manitoba and a comparison with other areas of North America in L. B. Keith's 1963 book Wildlife's Ten Year Cycle.

Detailed notes on a wide variety of subjects characterize the work of the Criddle brothers. In his lifetime Norman produced over one hundred papers; Stuart, now in his nineties, is still writing. Together the two brothers combined to produce a remarkably complete record of the natural history of early Manitoba that is unequalled anywhere on the prairies.

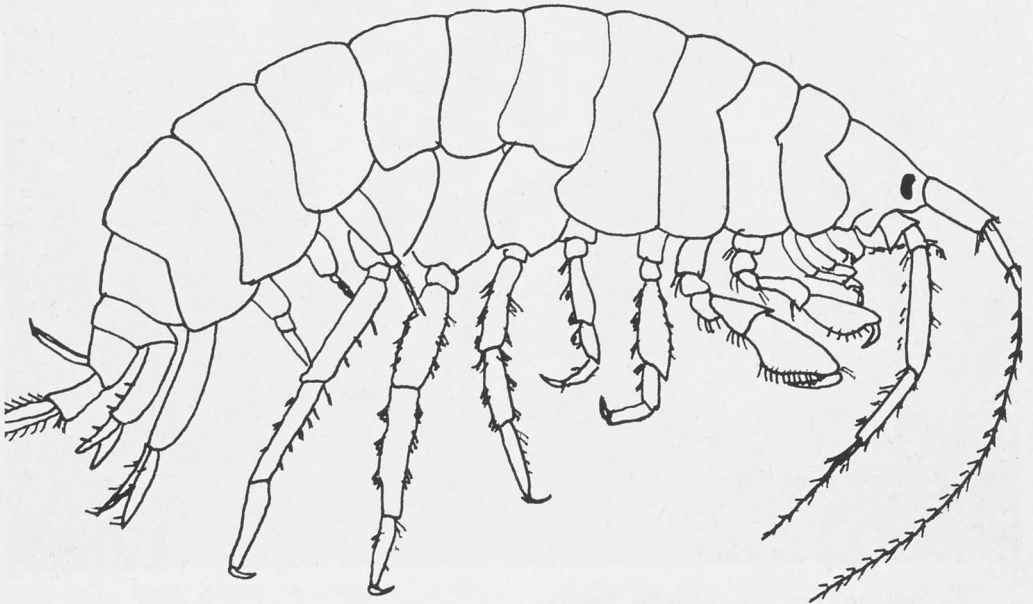
Carol A. Scott



"St. Albans" — the Criddle family home at Aweme still standing in 1970.
V. H. Scott, 1970



Yellowhead and Damselfly



Sideswimmer

More Than Just Ducks and Muskrats

Have you ever wondered how the myriads of aquatic invertebrates in a marsh manage to survive our winters? They can't migrate like the ducks or maintain a cozy environment in which to spend the winter like the muskrat. Many of the areas of water in a marsh are so shallow that they freeze to the bottom as the long winter drags on. The thin layer of ice which first appears in late October thickens progressively, forcing many of the invertebrates to migrate to deeper areas where they maintain an existence in conditions which daily become more and more crowded. One of the most common animals to find itself in this predicament is a small crustacean, frequently called the sideswimmer, whose density increases ten-fold during this period until it is such that approximately 400 would fit onto the surface of a long-playing record. Death comes to most of them soon afterwards as the last inch of water above the muddy bottom crystallizes and even the mud

itself holds its victims in permanent suspended animation. Though most sideswimmers perish in this way, small numbers find refuge, presumably deeper in the mud, and when ducks paddle on the surface of the open water once again, perhaps one out of every 400 of the original sideswimmers scurries about on the bottom.

However, not all invertebrates are as poorly adapted as the sideswimmer, most notably the midge larvae. Although some attempt to remain in unfrozen water, many remain unscathed in the mud and chunks of frozen mud can yield living larvae on being unfrozen in the laboratory. The body fluids of the larvae undoubtedly resist freezing but documented reports indicate that some at least can survive the formation of ice-crystals within their tissues.

At first sight these observations, though interesting, might appear unimportant since they deal with small animals living underwater. However, on

reflection one starts to realize that these vast numbers of small animals form a basic element in many food chains which enable an incredible diversity of life to exist in a marsh.

Whereas many of the invertebrates, like the sideswimmers have had their numbers decimated during the winter, the midge larvae are present in very large numbers in early spring. As temperatures rise and food becomes available many of the larvae start to feed, pupate and finally emerge as adults. Since many species of midges normally live in a marsh, different species emerge at different times throughout the summer, assuring the diverse bird populations of an abundant food supply. One particularly large species usually emerges in the Delta Marsh around the beginning of June and is present in such remarkable numbers that it almost blackens the air. Towards evening mating swarms of these midges assemble over the ridge separating Lake Manitoba from the marsh, frequently appearing as dark vertical columns of smoke against a red sunset. During these peaks of emergence many birds change their diet in order to take advantage of this sudden bonanza. It is very probable that many birds have adjusted their breeding season so that abundant food is available when their nestlings first hatch. The yellow-headed blackbird is said to feed its young largely on newly-emerged damselflies, close relatives of the dragonflies. Unlike the midge whose pupa swims to the surface before the adult emerges and flies away, the damselfly nymph climbs a bulrush or cattail stem and undergoes its transformation in more leisurely style. However, danger is ever present for soon after dawn you will find yellow-headed blackbirds checking the vegetation just above water level for newly delivered food parcels.

Although the utilization of aquatic insect life is quite obvious as one approaches any marsh bay or slough with its black terns and swallows, the utilization of aquatic invertebrates which never leave the water is less certain. Like the sideswimmers, many of them,

including leeches, water beetles, water bugs and snails commence the period of open water with severely depleted numbers and are unlikely to be an important food source initially. However, many of them, most notably the sideswimmers, are capable of reproducing at a remarkable rate. At 20 C sideswimmers can complete their whole life cycle in just over one month, enabling spring densities to increase by more than one hundred-fold by fall. The young produced by some leeches and snails also appear capable of maturing and producing more young of their own in a single summer. All this growth and reproduction which is made possible by the available food, including plants, detritus and animal matter means that by fall although the midge populations are low due to emergence, most of the other invertebrates are present in high densities. Predation on invertebrates by carnivorous beetle larvae, breeding ducks and more importantly fish take place, with some of the fish later being eaten by terns and herons. It also seems probable that in fall migrating ducks may well be utilizing this source of high-protein food, either unknowingly along with vegetation or by selective feeding. Those members of the aquatic community which evade predation must then face a different mortality factor as winter approaches and the ice gets thicker once again.

Thus the familiar pattern of reproduction and mortality follows season after season with those members of the community which can evade predation or avoid freezing being those which breed the following year. Natural selection working in ways like this occurs in all species throughout the whole marsh ecosystem whether they be sideswimmers or shovelers. To regard any member of the marsh community as dispensable is to misunderstand the workings of one of the most fascinating and relatively untouched ecosystems left on North America which we can all enjoy with the minimum of travel.

John Wright

Warbler Migration in Manitoba

Each spring a small army laden with binoculars, field-guides, notebooks, and often cameras comb the forests, marshes, and fields of Manitoba. This army of "bird-watchers" consists of a strange mixture of young and old, sophisticated and casual, but their quarry remains common to all — the feathered hordes returning from farther south. Probably no group appeals to a greater proportion of these observers than the warblers, of which over twenty-five species occur in Manitoba (Table I).

There are several reasons why this group — the warblers — offers such an appeal in the spring. Most are gayly, often gorgeously, coloured. Even a quick glance at the brilliant orange throat of a Blackburnian; the unbelievably bright yellow of the rump, crown, and sides of many Myrtle Warblers; or the exquisite contrast of the red tail patches against the jet black body of the American Redstart is an unforgettable experience. The accompanying sketches indicate a few of the many features to watch for on these highly coloured birds.

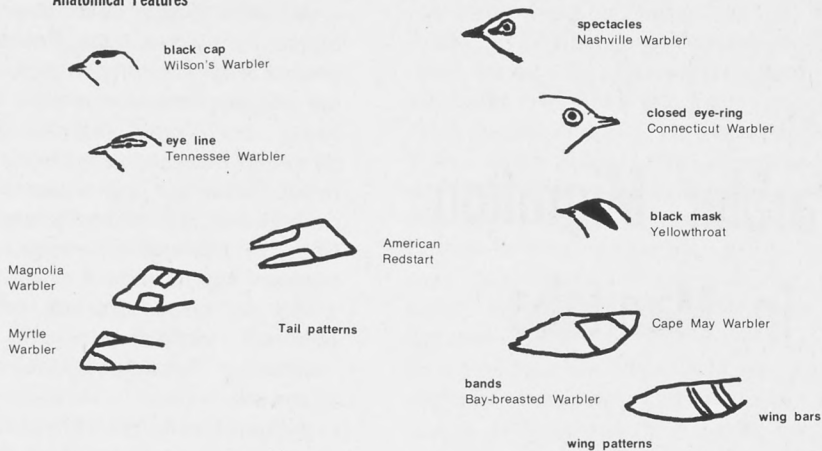
Warblers often migrate in mixed flocks, and a cold front or storm may have a "damming" effect on the migrants, causing literally thousands to remain in one place. As most of their migration is nocturnal, such cold fronts can be a great boon to bird-watchers, who are treated to a day of unending pleasure.

Warblers further catch the eye of many because, unlike the closely-related vireos, they are very active, most moving rapidly from one branch to another, using the "rapid-search" method of catching insects. Sometimes they also fly out after a flying insect in the manner more typical of the flycatchers. Some frequent the high tree-tops, others low bushes. The Ovenbird often runs along a log just above ground level, and the Northern Waterthrush may be seen "teetering" like a Spotted Sandpiper near a stream.

Although only the Yellow Warbler and Yellowthroat commonly breed in the prairie or marsh areas of the southern part of the province, one need not venture too far from Winnipeg or Brandon to find other warblers breeding. For although most of the others breed in the boreal forest, areas such as the Whiteshell, Birds Hill, and Riding Mountain National Park are **ecologically** north, even though they are geographically south. Thus, cottagers in the Whiteshell may enjoy watching a Blackburnian Warbler feed its young, while visitors to Birds Hill may find the "Yellow Warbler" songs are actually sung by Chestnut-sided Warblers.

A far different situation greets the observer when "fall" migration rolls around. In the first place, he will be hard pressed to discover just when fall migration really does get underway, as the birds start moving gradually south in August, and some may still be going through in November. This is at least partially caused by differing degrees of nest success or failure. The protracted nature of fall migration results in fewer of the enormous concentrations often seen in spring. Secondly, although the tail-wagging Palm Warbler and a few others appear much as they did in spring, most have replaced their brilliant colours and varied patterns with drab greens or browns and nondescript plumages. Many appear so similar as to challenge even the most experienced observer. Roger Tory Peterson aptly referred to them as "Confusing Fall Warblers" in his field guides.

Anatomical Features



Behaviour Patterns



Thus warblers have much to offer an observer in Manitoba. For the novice the variety and brilliancy of the spring plumages will always bring much delight. For those who prefer the satisfaction and award of a real challenge, the fall-plumaged warblers are ideal.

Table II, based on the late A. G. Lawrence's bird calendar, gives approximate dates on which several warbler species may be seen in Manitoba's southern areas. It should be noted that these dates refer to southern Manitoba as a whole, and many of the summer dates do not apply to Winnipeg or prairie areas, but do apply to boreal areas.

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Table I. Manitoba Warblers

Regular Species	
Black and White Warbler	
Tennessee Warbler	
Orange-crowned Warbler	
Nashville Warbler	
Yellow Warbler	
Magnolia Warbler	
Cape May Warbler	
Myrtle Warbler	
Black-throated Green Warbler	
Blackburnian Warbler	
Chestnut-sided Warbler	
Bay-breasted Warbler	
Blackpoll Warbler	
Pine Warbler	
Palm Warbler	
Ovenbird	
Northern Waterthrush	
Connecticut Warbler	
Mourning Warbler	
Common Yellowthroat	
Wilson's Warbler	
Canada Warbler	
American Redstart	

Casual Species	
Black-throated Blue Warbler	
Yellow-Breasted Chat	

Accidental and Hypothetical	
Blue-winged Warbler	
"Brewster's" hybrid	
Audubon's Warbler	
Cerulean Warbler	
Kentucky Warbler	
MacGillivray's Warbler	
Hooded Warbler	

In addition The Golden-winged and Parula Warblers probably breed regularly in small "pockets" of southern Manitoba.

- Regular** — known to occur somewhere in Manitoba in at least part of every year.
- Casual** — not known to occur every year, but with at least five records for Manitoba.
- Accidental** — less than five records for Manitoba.
- Hypothetical** — at least one record by a reliable observer, but no verified records for Manitoba.

Table II. Approximate Dates of Occurrence of Some Warblers in Southern Manitoba (from Lawrence 1958) . . . extreme, — average

	April				May				June				July				August				Sept.				Oct.			
	1	8	15	22	1	8	15	22	1	8	15	22	1	8	15	22	1	8	15	22	1	8	15	22	1	8	15	22
	to	to	to	to	to	to	to	to	to	to	to	to	to	to	to	to	to	to	to	to	to	to	to	to	to	to	to	to
	7	14	21	30	7	14	21	31	7	14	21	30	7	14	21	31	7	14	21	31	7	14	21	30	7	14	21	31
Myrtle																											
Orange-cr.																											
Palm																											
Black and White																											
Northern Waterthrush																											
Tennessee																											
Black-poll																											
Ovenbird																											
Cape May																											
Yellow																											
Magnolia																											

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